CENTERING PIN

Known from WO 2004/069 468 A1 is such a receiving element having a bolt that, in the area of its external surface, which is largely parallel to a longitudinal axis, has at least two recesses with apertures. Arranged in these recesses are pins that comprise wear-resistant material or contain such material and that extend somewhat radially through said apertures and project over the external surface with a predefined overhang. Such receiving elements can be introduced into bores of at least one component for fixing and/or aligning for subsequent machining. For instance, if two metal sheets are to be joined to one another by welding, these contain receiving bores that match one another and into which a receiving element of the type cited is subsequently introduced for centering and receiving the metal sheets. In the case of large components in particular, a plurality of such receiving elements are usefully provided as production or assembly aids. The receiving elements can also be employed as holding pins and/or guide pins in machines, systems, or machining systems for components, these being for instance automatic welding machines, punches, or presses. Production of these previously known receiving elements requires a certain complexity because first the at least two lateral apertures must be added to the bolt, which normally comprises metal, and then the at least two pins, which comprise or contain sintered material, must be introduced into the apertures, whereby in a useful manner in a further machining step the pins projecting outward from the bolt are machined such that the surface areas of the pins that overhang farthest radially are located on a common surface. Even without performing this latter method step, adding at least two apertures to the bolt and preparing and inserting the two aforesaid pins entails production complexity that is not insubstantial.

Moreover, known from JP 02 290 696 A is a receiving element that has a ring comprising a sintered material, through which ring passes a bolt provided with a tip. The end of the bolt facing away from the tip is provided with a thread that engages in a threaded bore of an element provided with a male thread, the aforesaid sleeve being clamped axially between the bolt tip and the element. The production of the cylindrical sleeve made of sintered material is quite complex in order on the one hand to avoid radial play in terms of the bolt that passes through and on the other hand to avoid undesired radial compression and associated waste during production. In

addition, this receiving element also comprises at least three parts, specifically sleeve and bolt and the threaded element that has a male thread, the various machining steps being disadvantageous especially during serial production of large numbers of units.

Proceeding from this, the underlying object of the invention is to further develop the receiving element with less structural complexity while avoiding the aforesaid disadvantages such that high dimensional stability and positioning accuracy are assured for a long service life. The production of the receiving element should not require great complexity and/or material consumption, and should be economical to perform. Moreover, it should be possible with no problem to assure the electrical insulation that is used when the receiving element is used or employed for producing a weld joint, in particular for metal sheet parts and/or one metal sheet part with threaded female elements. Furthermore, the receiving elements should especially be used in welding systems or devices, in particular for producing pressure welded joints.

This object is attained in accordance with the features provided in patent claim 1.

The suggested receiving element is characterized by a simple and functionally appropriate structure. The bolt comprises wear-resistant sintered materials, preferably oxide ceramics or non-oxide ceramics, in particular Al_2O_3, ZrO_2, or Si_3N_4, or mixtures resulting therefrom, and contains at its forward end a recess in which the tip, comprising metal, in particular steel or high-grade steel, engages and is attached at one end section. In the interior of the bolt, a direct or immediate connection is provided between the tip, via its end section, and the recess, embodied in particular as a blind hole, and thus the bolt. The recess, which is preferably coaxial with the longitudinal axis and/or penetrated thereby, permits a lasting and loadable connection in the axially comparatively short forward area of the bolt without a reduction in the cross-section of the bolt, whish is made of the high-performance ceramics or sintered material used, being necessary over the entire axial length. The interiorly situated forward connecting area extends only over a fraction of the entire length of the bolt, advantageously less than 50%, preferably less than 30% thereof. The end section of the tip and/or the forward connecting area possesses an axial length that is substantially smaller than the total length of the bolt. Furthermore, it is particularly important that the interiorly situated connecting area is reliably protected from attack by an environmental medium, for instance steam or aggressive gases. The fastening of the tip or

its end section in the axial recess of the bolt is in particular embodied as an adhesive joint or shrink fit or press fit or clamp connection. Mechanical processing, in particular circular grinding, is used to grind the exterior surface of the bolt embodied from sintered material and/or high-performance ceramics to the required aperture diameter for the component to be processed, in particular metal sheet or threaded female element.

In contrast to receiving elements with tips made of ceramics, which can break off relatively easily, particularly when they have small diameters, using the metal tip prevents the very disadvantageous breakage with a high degree of functional assuredness. Thus inventive components, in particular metal sheets, can be joined to one another with no problem using the suggested receiving elements in particular in welding tools and/or pressure welding tools, even with threaded female elements that are quite small, in particular with M4, M5, M6, or M8 female threads, avoiding failure times and idle times for the welding tools or automatic welding systems and attaining long useful life periods. The bolt is produced in particular by dry pressing, extrusion, or in an injection molding process and/or by mechanical processing. The bolt is advantageously embodied as a part, whether as tube or bar, and is provided and/or fitted with the metal tip at the forward free end.

Moreover, in particular for optimizing the insulation, a fastening body made of an insulating material, in particular plastic, can be provided at the other end of the bolt, an adhesive joint, shrink fit, press fit, or clamp connection preferably being provided. By using high-performance ceramics for the bolt in conjunction with the tip made of metal, in particular steel, and optionally arranging the fastening body made of insulating material at the other end, the inventive receiving element is characterized primarily by the following improved properties: specifically, high wear-resistance and/or extremely long service life and/or good dimensional stability and/or precise positioning accuracy and/or high surface quality and/or optimized electrical insulation.

Special further developments and designs of the invention are provided in the subordinate claims and in the following description of particular exemplary embodiments.

The invention is explained in greater detail in the following using the exemplary embodiments depicted in the drawings, without this resulting in any limitation.

Fig. 1 is a schematic depiction of an axial section of a first exemplary embodiment;

Fig. 2 is an axial section of another exemplary embodiment having a fastening body made of an insulating material for additional insulation.

In accordance with Fig. 1, the receiving element contains a bolt 2 and a tip 4 that is produced as a separate component and that with its end section 6 engages in a recess 8 of the bolt 2 at the latter's forward end. The bolt 2 comprises or contains wear-resistant sintered material, preferably oxide ceramics, such as in particular Al_2O_3 or ZrO_2, or non-oxide ceramics such as Si_3N_4, or mixtures resulting therefrom. The forward section 10 of the pin 4 projects out of the bolt 2 and possesses an exterior surface 12 that is at least approximately and/or largely conical. In the exit area from the bolt 2 the tip 4 or its forward section 10 possesses a maximum external diameter 14 that is smaller by a prespecified amount than the external diameter 16 of the bolt 2 or its exterior surface 18. The recess 8 in the forward end of the bolt 2 is preferably embodied as a blind hole and the end section 6 extends axially over only a fraction of the entire length of the bolt 2.

The exterior surface 18 runs largely parallel to the longitudinal axis 20 of the bolt or the entire receiving element and is embodied in particular as a cylindrical exterior surface that is coaxial with the longitudinal axis 20. Alternatively, the exterior surface 18 can have a polygonal exterior contour. As can be seen, a transition area 22 that tapers toward the end section 6 is present between the forward, in particular conical, end section 6 and the exterior surface 18 of the bolt 2. This transition area 22 is usefully a component of the bolt 2, but the transition area 22 can alternatively also be a component of the tip 4. The receiving element inventively possesses a stepped exterior contour with the forward section of the tip projecting out of the bolt, the maximum external diameter 14 being substantially smaller than the external diameter 16 of the bolt. The transition area 22 possesses a substantially smaller axial extension than the end section 6. Moreover, the takeout angle or cone angle of the transition area 22 is preferably substantially larger than the takeout angle or cone angle of the end section 6.

Due to the substantially smaller external diameter 14 of the end section 6 relative to the external diameter 16 of the bolt 2 and/or due to the inventively provided transition area 22, certain

introduction of the receiving element into an associated bore of the components to be centered in particular by means of the receiving element, especially metal sheet and threaded female element, is assured. The tip 4 comprises metal, in particular steel or high-quality steel, so that, even when the external diameters of the receiving element and the bolt 2 are quite small, damage to the tip 4 is prevented and it is prevented from breaking off and/or a long service life or useful life is attained for the receiving element.

The direct connection of the tip 4 or its end section 6 in the correspondingly embodied recess 8 is in particular embodied as an adhesive joint, shrink fit, press fit, or clamp connection. The recess 8 is advantageously coaxial with the longitudinal axis 20. For precise axial positioning of the tip 4 in the bolt 2, a step 24 is present between the axially projecting forward section 4 and the end section 6 arranged in the recess 8 such that the maximum external diameter 14 of the forward section 10 is larger by a prespecified amount than the external diameter 26 of the end section 6. The step 24 thus forms a defined stop, in particular during insertion and/or when producing the connection between the bolt 2 and the tip 4, which provides exact axial positioning and ultimately a defined axial length of the entire receiving element. Moreover, impermissibly high loading or even destruction of the connection between the tip 4 and the bolt 2 is avoided by means of the step 24.

At its end facing away from the tip 4, the bolt 2 contains a fastening body 30 for placing the receiving element in a tool, in particular a pressure welding tool. The fastening body 30 contains a flange embodied as a radial extension for placement in the tool. At this point it should be stated that the receiving element is preferably embodied as a centering pin or receiving pin and is used for centering and receiving components, in particular a plurality of metal sheet parts or at least one metal sheet part having a threaded female element. Furthermore, the receiving element is provided primarily for employment and/or use in welding tools, in particular pressure welding tools or apparatus or machines. Moreover, the inventive receiving element is characterized by small external dimensions. Thus the external diameter 16 of the bolt 2 is largely in the range of 3 to 12 mm, preferably 3.5 to 10 mm, and in particular from 4 to 8.5 mm. Thus when using the inventive receiving element even very small threaded female elements having internal diameters of M4 or M5 or M6 or M8 threads can be centered by means of the receiving element or received thereby and in associated machines or tools, such as in particular pressure welding machines, can

be joined to metal sheet parts, whereby even and specifically with such small radial dimensions the tip is prevented with certainty from breaking off due to the suggested embodiment of the metal tip 4 and its integration into the bolt 2 made of high-performance ceramics and/or wear-resistant sintered material and ultimately high functional security and/or service life is attained. Fig. 2 illustrates another exemplary embodiment, according to which the fastening body 30 is not an integral component of the bolt 2 but rather is joined to the bolt 2 as a separate component. The fastening body 30 comprises a special insulating material, in particular plastic, in order to assure additional and/or improved insulation of the receiving element with respect to the tool, in particular a pressure welding tool. As can be seen, at its back end the bolt 2 contains a second recess 32 in which a connecting section 34 of the fastening section 30 engages. The connecting section 34 is joined in the second recess 32 by means of an adhesive joint or shrink fit or press fit or clamp connection. Furthermore, the fastening body contains a radial expansion and/or a flange 36, the external diameter of which is greater than the external diameter of the bolt 2. A step is present between the connecting section 34 and the flange 36, this providing defined placement and/or axial alignment of the fastening body 30 with respect to the bolt 2. As in the exemplary embodiment in accordance with Fig. 1, between the two recesses 8 and 32 the bolt 2 contains a massive intermediate area 38 that assures high stability and/or strength of the bolt 2 and thus of the entire receiving element.

Alternatively, in the framework of the invention the bolt 2 can have a single central recess that extends across the entire axial length. If, corresponding to Fig. 2, a separate fastening body 30 is provided at the back end, however, there is no immediate axial connection between the tip 4 arranged at the forward end and the fastening body 30 and consequently axial connecting forces between the tip 4 and the fastening body 30 are avoided in an advantageous manner. It is hereby also further stated that an interiorly situated recess can extend axially through the entire length of the bolt, including its integrally formed connecting body, as well, alternatively to the embodiment in accordance with Fig. 1. However, the connecting area in such an embodiment is provided solely on the forward end of the bolt 2.

Legend

2	Bolt
4	Tip
6	End section of 4
8	Recess in 2
10	Forward section of 4
12	Exterior surface of 6
14	Maximum external diameter of 6
16	External diameter of 2
18	Exterior surface of 2
20	Longitudinal axis
22	Transition area
24	Step between 4 and 6
26	External diameter of 6
30	Fastening body
32	Second recess in 2
34	Connecting section of 30
36	Flange of 30
38	Massive intermediate area of 2